

Headquarters U.S. Air Force

Integrity - Service - Excellence

Global Engagement VI



U.S. AIR FORCE

18 Apr 2002

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<http://www.xo.hq.af.mil/xoc/>



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Situation

Essential Task & Purpose

Defense strategy

Assure, Dissuade, Deter & Decisively Defeat
Reorient, Cope with Challenges, Transform Forces



USAF Vision - Partners in the Joint Team

Integrating Air, Space & Info Ops...
Improving Expeditionary Capabilities...
Fielding Critical Future Capabilities...
Through Innovative & Adaptive Processes



Task & Purpose

Execute GE VI in context of future operational challenges:

Examines Joint concepts

Links to other USAF, Service, & Joint events

Develops transformational capabilities

Continues a path toward USAF Vision / Joint Vision

...to ensure future full spectrum battlefield dominance



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GE VI Mission

Mission

- Investigate air & space power & emerging CONOPs in future Joint / Coalition warfighting
- Recommend high value force multipliers & future warfighting concepts & capabilities



3-8 Nov 02

Objective

- Explore 2015 Joint / Combined operational concepts:
 - Rapidly dominate battlespace / set conditions
 - Transition to sustained Joint operations

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Approach

Joint Concept-Based Wargaming

- Focus on concepts ➡ Overarching, enabling & system CONOPs
- Jointly developed ➡ Component Joint CONOPs
- Realistic context ➡ Set 2015 operational warfight - OPLAN, Theater Engagement Plan, “realistic scenario” (MTW+ SSC+ Homeland Security)
- Minimize “fairy dust” ➡ Detailed pre / post game analysis -- realistic operational warfighting environment

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Joint Overarching CONOPs

Joint 2015 CONOPs: *Deter & Decisively Defeat* 2015 Forced Entry Operations

Overarching Service & Joint CONOPs

GSTF / GRTF

Horizontal Integration / TCT

EBO / ONA → PBA

Objective Force

Expeditionary Maneuver Warfare

Homeland Security

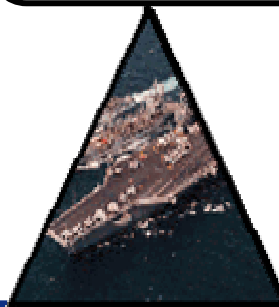
Concept “Glue”

C2 / ISR IO

Lift / Sustainment

Fires

Counterair / TAMD



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GE VI Campaign Planning Key Tasks & Planning Phases

Key Tasks

- Identify core planners...functional, service, & allied
- Identify / incorporate concepts / CONOPS into future campaign plan
 - Warfighting Concepts: Objective Force, Network Centric Operations, EMW, Dominant Maneuver, GSTF...
 - Functional Concepts - C4ISR, Space, IO, Log, Mobility, Kill chain
- Develop CJTF campaign plan to include branches and sequels

Planning Phases

- | | |
|--|-----------|
| ■ Phase I – Mission Analysis (Determine mission) | Jan - Feb |
| ■ Phase II – COA Development (Full COA & TPFDD) | Mar - May |
| ■ Phase III – COA Refinement (analysis & assessment) | May - Aug |
| ■ Phase IV – Rehearsal (“Rock Drill”) | Sep |



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Improving Analytic Rigor Detailed Analysis

Insights >>> Analysis >>> Action

Seamless Transition between Pre-game Analysis,
Wargame Execution, Post-game Analysis Results in:

- Analysis used pre- / post-game
- Better insights for decision makers
- Return on investment for USAF

*Pre-game
Analysis*



*Post-game
Analysis*

Actionable
Information

CONOPs

Capabilities

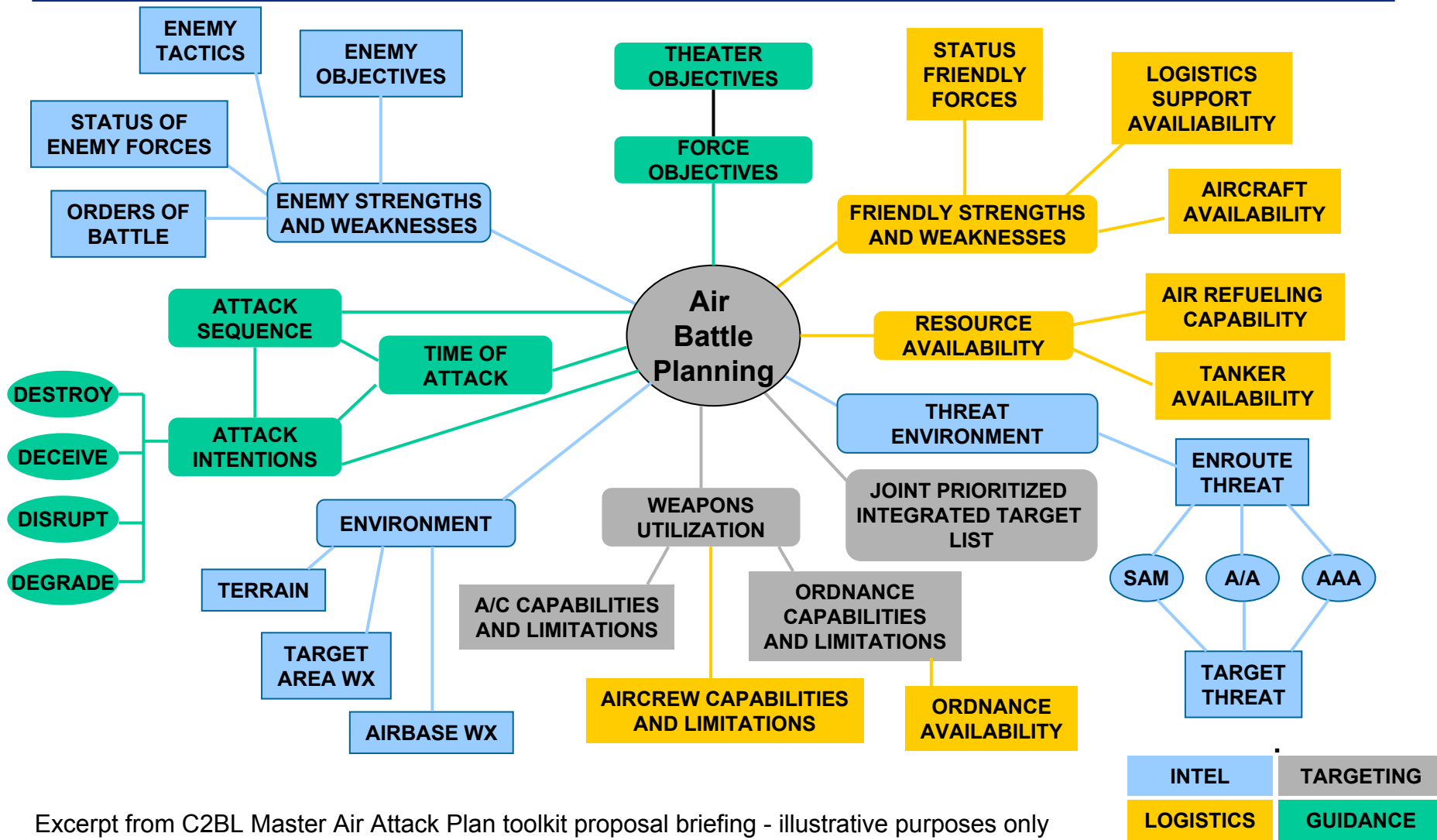
Programs

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Knowledge Map

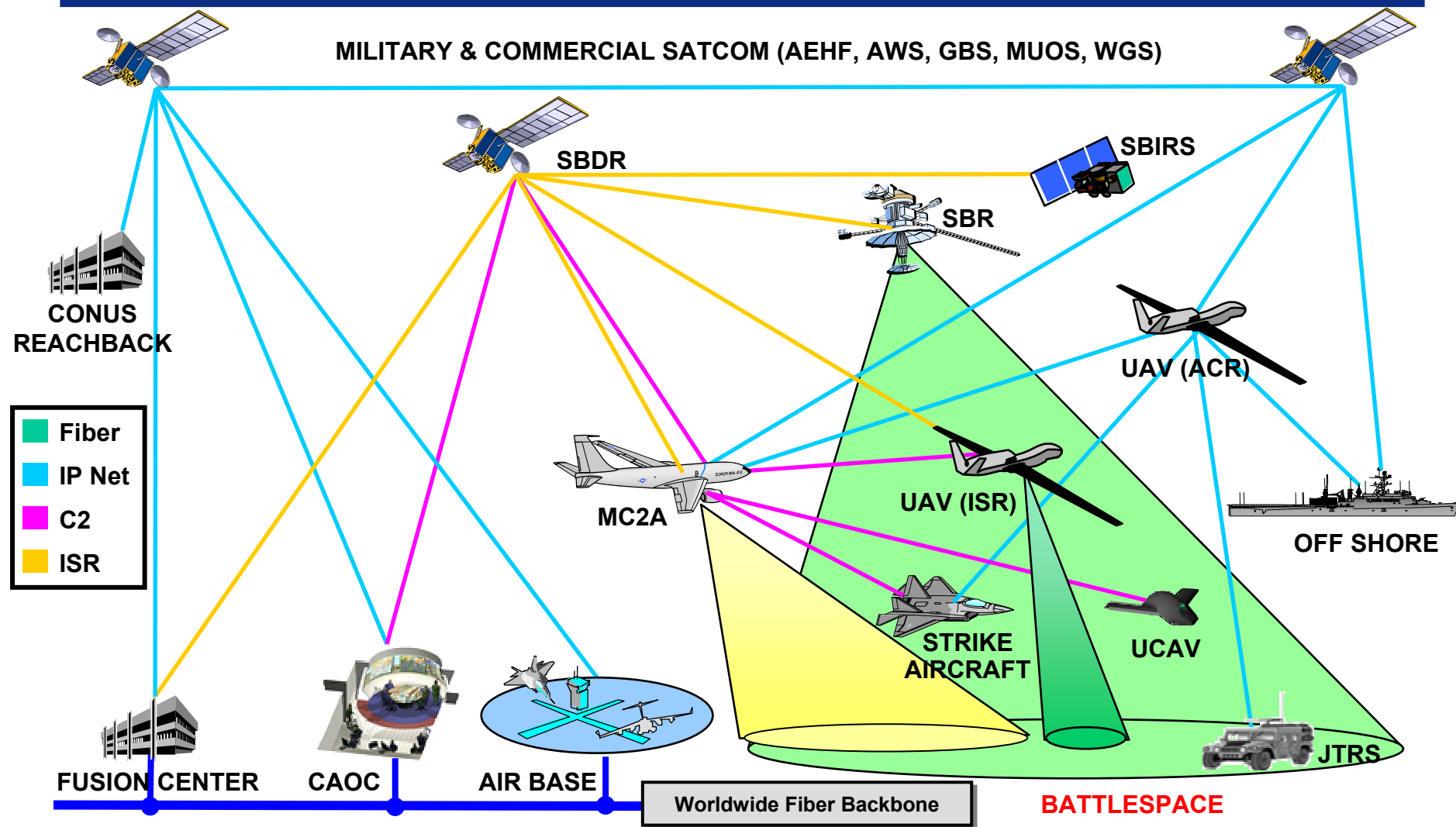


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GE VI C4ISR Architecture

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BACKUP Slides



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Wargame Assessment Support Issues



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Assessment Issues

Tasks and Issues

What do I want to do?
What units do I need?
Where can I put them?
When can I get them?
Can I sustain them?
What tasks do I need to do?
Priority of tasks?
Phase definition and MOE?
Transition criteria?
Target sets, ISR, Defense?
Sorties production?
Combat power?
Apportionment?
Combat results?
Replan?
Retask?

Planning/Eval Factors

Sorties/day/acft/location
Fuel/sortie
Threat lethality
Kills/losses/engagement
Targets/weapon
Weapons/sortie/mission
Sorties/base
Abort rates
Base/port throughput
Gnd unit advance rates
ISR impact on targeting
Network contributions
Weapons load mix
TMD leaker predictions
IO effectiveness

Measures of Effect

Force closure success
Airbase operability
Sortie availability
Weapons inventory
Sorties flown
Targets destroyed
Aircraft killed
Aircraft lost
Network integrity/impact
FLOT movement
Actual vs planned MOE
Impact on enemy plan
Sustainment projections
ISR capability vs need
TMD leakers and impact
Targeting effectiveness



Information Environment

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<i>Vision</i>	Vigilance	Reach	Power
<i>Translation</i>	See everything	Go anywhere	Kill stuff
<i>Common Terms</i>	Awareness Understand Enemy Intent Sensor Management TPED	Strategic Mobility Deployment / Sustainment Beddown / Standoff Sortie Production	Engage / Fight Kill / Survive / Penetrate TAMD / SEAD Halt / Win
<i>Tools</i>	Visualization - Status - Summary Reports - Query System - RFI - Library - COA Analysis- Assessment		
<i>Observables</i>	Space ISR Available Airborne ISR Available Comm Available Key Indicators & Warning Assessment of Intent Enemy Order of Battle Infrastructure Assessment	Base & Port Status Airlift & Sealift Available Sorties & Weapons Available Tankers & Theater Lift Fuel Inventory - - -	Sorties Flown Targets Hit Kills / Losses Weapons Expended - - -
<i>Products</i>	Collection Priorities Orbit Placement & Tasking -	TPFDD Update Dispersal Decisions -	MAAP Apportionment Operational Assessment

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Past Observations

- **Focus on people and ideas, assessment must support accordingly**
 - **Stress operational-level linkages between capabilities, choices, effects**
 - **Stay out of tactical weeds but be able to 'drill down' when needed**
- **Many good steps forward in GE-V**
 - **Central database, full TPFDD, explicit network representations**
 - **Long-term value from dedicated post-game analysis**
- **Some analytical rigor needed to bound issues, provide credibility**
 - **Detailed analysis takes more time than is ever available in wargame**
 - **Proper analysis best done pre-game and post-game with accredited analytical models/tools**
 - **Linked models for assessment, even with central database, is still excessively painful and misses important factors**
 - **Easy to confuse assessment and adjudication tasks with visualization / briefing support tasks**



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What We've Learned

- **One constant: Change**
 - Wargame goals, schedules, guidance constantly changing
 - Supporting toolset must be adaptable to changing needs
- **Analysis tools not easily forced into wargame setting**
 - Wargame assessment typically spontaneous, judgement-based
 - Proper analysis is a planned, thoughtful, fact-based, iterative process
 - No great end-to-end single models available
 - Real-world C2 systems, databases also not a good fit for this setting
- **Time for detailed analysis is pre/post game**
 - Requires scenario, CONOPS, CONPLAN, TPFDD, thorough coordination with current warfighters to capture thinking
 - Key to success - harness pre-game analysis, use efficiently during game execution, return to post-game analysis
 - To make a difference, must stand up to programmatic-level scrutiny



More Lessons Learned

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■ What works

- Encourage real-world warfighting constructs, keep at high level
- Easy access to planning factors, guidelines, 'brain box'
- Central database for continuity, consistency, archive
- Data automation for labor-intensive repeatable tasks

■ What doesn't work

- Cold start -- without ConPlan, notional TPFDD, COAs
- Forcing players to think, discuss, plus be data entry technicians
- Forbidding players access to needed and available information
- Late changes, end-to-end model runs before assessors can finish
- One-sided models or constraints
- One-size-fits-all models..... must be able to incorporate best available real-world tools and data, always a moving target



GE-VI Analysis Challenges

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- **Capture constraints that typically are missed**
 - Sortie production as function of airbase operability, dispersed ops concepts, mission tasking
 - Intra-theater lift
 - Tanker requirements
 - Sustainment
 - Communications
- **Examine operational-level choices, impact, constraints**
 - Effects Based Operations
 - Information operations
 - Comm architecture
 - TPED process
- **Better integration of Threat, other Services, Coalition, Agencies**
 - Engage early to understand / model capabilities and concepts



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Where We're Going

- **Become informed and demanding customers of analysis tools and products**
 - Invest time to learn what's available, strengths and weaknesses
 - Get best available data at designed classification level from authoritative sources (program offices, AFSAA, Service SMEs, national agencies)
 - Capture planning factors, including those typically missed
- **Construct a flexible wargame information environment**
 - Make efficient use of player time and expertise, more decision support tools
 - Build assessment tools and process around human assessors
 - Harness what we've learned in pre-game analysis
 - Capture game inputs and events for post-game analysis
- **Wargaming integration testbed**
 - Establish full time place to build databases and scenario
 - Integrate analysis products and visualizations
 - Assemble wargame information environment



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GE VI MS&A Game Flow



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Pre-Game Analysis

- **Pre-Game analysis using accredited tools**
 - Air Force Standard Analysis Toolkit as a starting point
 - JFAST, THUNDER, EADSIM, COSMOS, SMAT, STK as initial core
 - All available data, study results, planning factors, rules of thumb
 - Other models if sponsored, funded, supported, time / data available
- **Robust scenario with CONOPS, CONPLAN, TPFDD is essential**
 - Analyses must address sufficiency gaps and sensitivity / excursions
 - Need authoritative sources for future system capabilities
 - Need end-to-end C4ISR architecture for analysis
 - Need robust infrastructure analysis





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Decision Support

- **Improved access to automated systems on wargame intranet**
 - ...but designed to keep keep players in discussions instead of at keyboards
 - Simple and intuitive interfaces, with trained staff assisting as 'knowledge guides'
 - Questions about the future imply need for a 'projection' not commonly found
 - Knowledge Map - visual menus to areas of info, search system, HTML links
- **Library items - many online during pre-game planning**
 - Builds on AFSAA 'Brain Box' concept
 - Joint and Service doctrine, pubs, planning guides, military science classics
 - Weapon system toolboxes, employment guides (3-1, 3-3), weapon effects (JMEM)
 - Maps, imagery, airfield and port diagrams, animated visualizations
 - Analytical studies and reports, RAND references, vulnerability assessments
 - Items of information and briefings - WMD, HEMP, Chem-Bio, GPS jamming....
 - Friendly and enemy orders of battle

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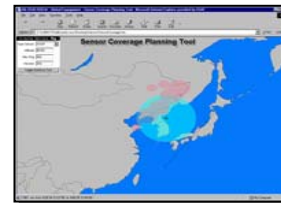


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Decision Support

- **Interactive query - ASP interface to game database**
 - Answer as much as practical at data level
 - Enable feasibility assessment, analysis of alternatives before moves
 - Perceived current status of friendly and enemy forces, facilities
 - Common Operational Planning Picture
 - Visualization tools for unit location, sensor coverage, threat envelopes
- **Request for Information System**
 - Reserve for subjective calls, issues that must be coordinated with control / NCA
- **Collect data on all query traffic**

Unit FM	Name	Size	Arrival Day
aaa	FtrSq1	80.0	C01
bbb	UAV2	87.7	C02
ccc	FtrSq2	19.5	C02
ddd	FtrSq3	24.4	C02
fff	FtrSq4	30.8	C03
ggg	UAV1	72.2	C03
iii	UAV3	64.8	C04
hhh	ISR4	4.8	C04
jjj	UAV4	11.3	C04
kkk	ISR1	53.6	C05
eee	THAAD1	400.0	C09
lll	ISR2	52.6	C10





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Assessment Support

- **Strike a balance between detail and aggregation, level of uncertainty**
 - Continuous entity-level simulation not practical
 - Identify major areas for evaluation that can be addressed effectively
 - Use negotiated assumptions to cover 'knowability' gaps, instead of nothing
- **Assessment system built around assessors**
 - Quick-turn tools that harness scenario-specific analyses
 - Define the operational-level input / output functions
 - Human override opportunities at all key stages
 - Will always be a projection and default values to modify and build on
 - Mirror analysis model constructs and algorithms where practical
 - LP solver to optimize sortie assignment in ATO, similar to THUNDER
 - Lookup tables to interpolate best-matched cases to current scenario

		Mission Effectiveness			
		CAS	BAI	INT	
A-10 Wing		60	50	5	
F-15E Wing		5	30	80	
F-16 Wing		20	70	40	
Sorties Desired		20%	45%	35%	
		Sorties Allocated			Sorties Available
A-10 Wing		24	16	0	40
F-15E Wing		0	0	40	40
F-16 Wing		0	38	2	40
Sortie Demand		24	54	42	120
		24	54	42	Total
		Objective Function (Maximize)			8180

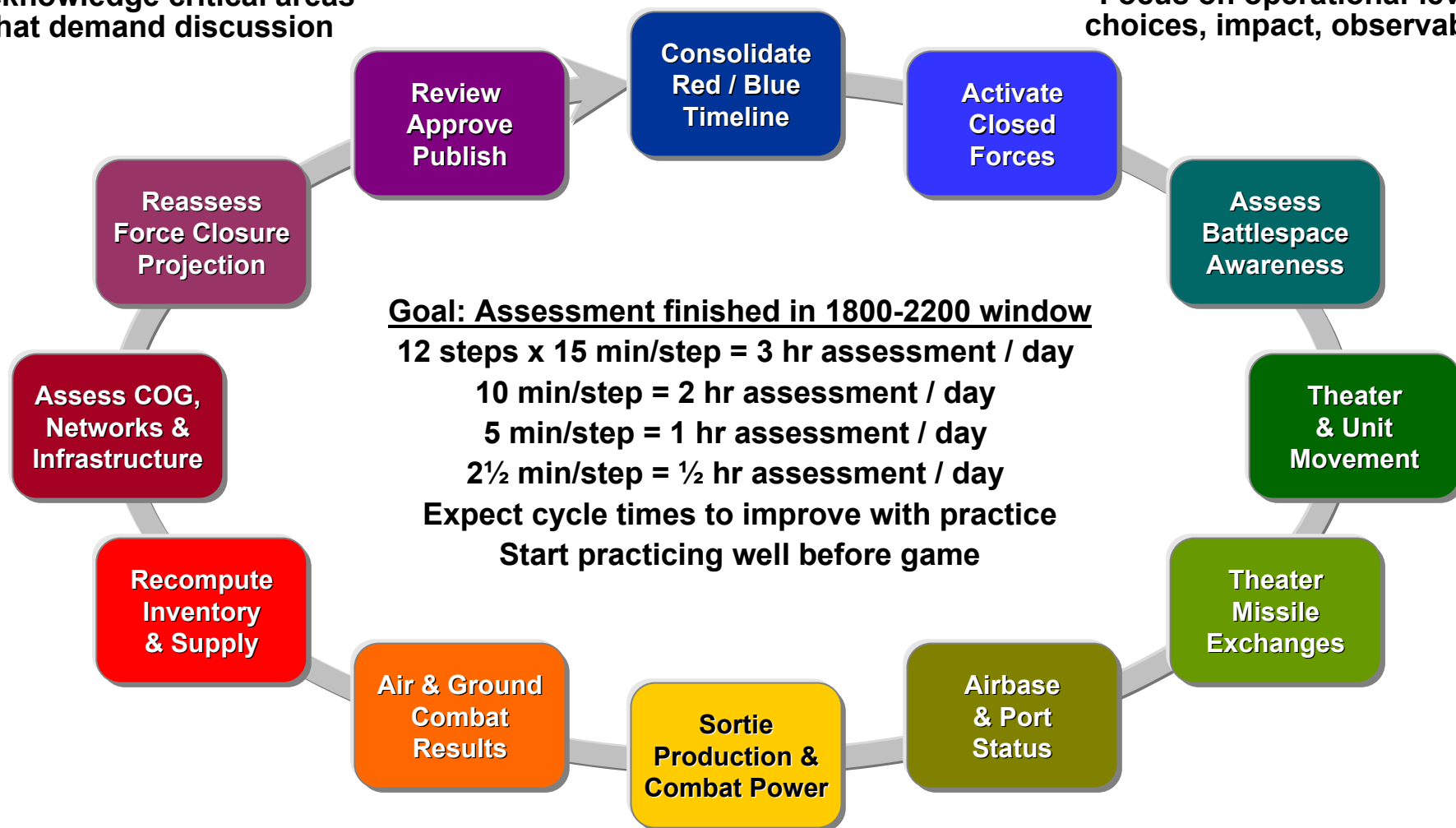


Incremental Assessment

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**Acknowledge critical areas
that demand discussion**

**Focus on operational-level
choices, impact, observables**



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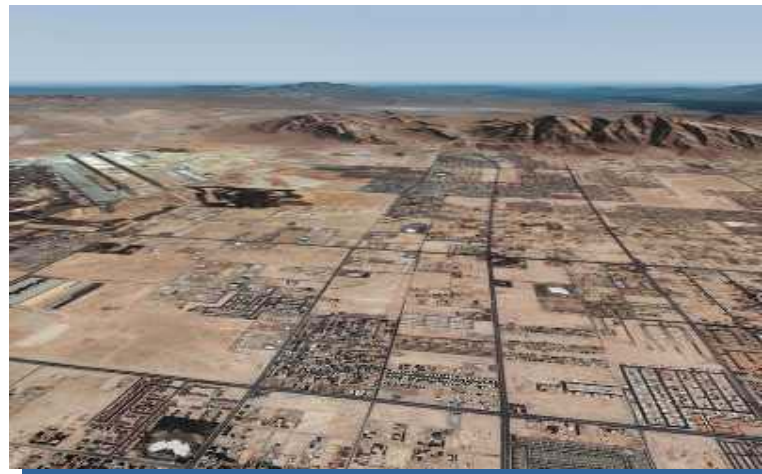




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Post-Game Analysis

- **Post-game analysis using accredited tools**
- **Compare game assessments with pre-game analysis**
- **Capture human assessor overrides and rationale from game**
- **Identify areas that merit further exploration**
- **Expand outreach to find related studies**
- **Find sponsors for needed work**
- **Support some analysis directly**
- **Identify areas for tool set improvements**





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Major Near-Term Tasks

- **Domain Analysis - Refine Inputs, Observables, Products**
- **Stand up ASP-based intranet to build on**
- **Identify questions we will have to answer**
- **Identify where information may come from**
- **Methodology to harness models in pre-analysis**
- **Develop algorithms and approximations where needed**
- **Start design of decision support tools (COA, status)**
- **Start design of assessment support tools (adjudication)**
- **Build list of pre-analysis assignments**
- **Build list of 'library' items needed, and ID providers**
- **Plan transition to execution phase and pre-analysis**

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